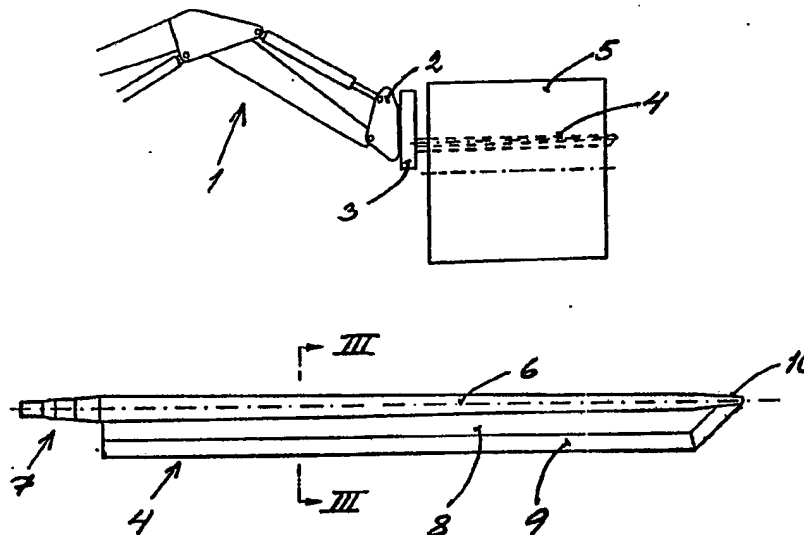




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>5</sup> :  A01D 87/12, A01F 29/00	A1	(11) International Publication Number: <b>WO 91/17650</b>  (43) International Publication Date: 28 November 1991 (28.11.91)
<p>(21) International Application Number: PCT/SE90/00316</p> <p>(22) International Filing Date: 11 May 1990 (11.05.90)</p> <p>(71) Applicant (for all designated States except US): AB ÄLÖ-MASKINER [SE/SE]; Fack, S-905 90 Umeå (SE).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): LINDBERG, Arne [SE/SE]; PL 7202, S-905 90 Umeå (SE).</p> <p>(74) Agents: KARLSTRÖM, Lennart et al.; AB Stockholm Patentbyrå, Box 3129, S-103 62 Stockholm (SE).</p> <p>(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE*, DE (European patent)*, DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.</p>		<p>Published With international search report. In English translation (filed in Swedish).</p>

(54) Title: APPARATUS FOR LIFTING, TRANSPORTING AND CUTTING BALES



## (57) Abstract

This invention relates to a knife means for lifting, transportation and dividing into pieces of bales within agriculture, preferably ensilage bales. According to the invention the knife means is characterized by the combination of the following features: the knife means (4; 12) is intended to be fastened to the fore portion (2) of a hydraulic lifting device (1) on a vehicle, for instance a tractor; the knife means (4; 12) has an elongated form and is intended to cooperate with the hydraulic lifting device (1) in that way that the knife means (4; 12) can be brought to move essentially in the vertical plane with an essentially horizontal extension; the knife means (4; 12) is designed with a cutting edge (9) in its lower portion, whereby the knife means can effectively cut itself through the ensilage bale when making the essentially vertical motion; the knife means (4; 12) has a broad, carrying surface at the top so that after insertion into the ensilage bale it can effectively lift and/or move the same.

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Apparatus for Lifting, Transporting and Cutting Bales.

This invention relates to a knife means for lifting, transportation and dividing into pieces of bales within agriculture, preferably ensilage bales.

5 In later times when storing hay it has become popular among farmers to roll up the hay strings to a large bundle for making bales and then put the hay bundle into an airtight plastic sack. This plastic sack is allowed to remain lying on the ground until feeding of the animals shall be done. This  
10 handling is today mechanized to a great extent. The problem, however, is the dividing into pieces of the large ensilage bale during the feeding. This is today made by trying to unroll the bale or tear/cut it up into suitable pieces. Of course, this is a time-consuming and work-requiring procedure.

15 This invention relates to facilitate the dividing into pieces of ensilage bales at first hand. This has been made possible by a knife means having the features mentioned in the following claims. Due to the design of the knife means and due to the fact that the knife means is intended to be mounted onto the hydraulic lifting device of a vehicle, the knife means can  
20 be effectively cut through the ensilage bale, which gives a very rapid and effective dividing into pieces of the bale.

A preferred embodiment of the invention shall be described more closely below with reference to the accompanying  
25 drawings, where Fig. 1 shows a schematical view of an apparatus for dividing the object into pieces, i.e. a hydraulic lifting device and a knife means cooperating with the lifting device in engagement with an ensilage bale, Fig. 2 shows a side view of the knife means, Fig. 3 shows a section through the line III-III of Fig. 2, and Fig. 4 shows a second embodiment of the  
30 knife means.

Referring to Fig. 1 is shown there a schematical sketch over the apparatus for dividing the object into pieces. This one comprises a hydraulic lifting device 1 which is fastened on  
35 a vehicle, not shown, which is suitably a tractor. On the fore portion 2 of the lifting device is detachably fastened an attachment device 3. This one is intended to carry a knife means 4 which is suitably detachably fastened in the attachment

device by means of a bolt joint. Due to that fact the knife means can be easily exchanged if it is damaged. The knife means 4 has an elongated form and projects essentially perpendicularly from the attachment device. Due to that fact the knife means by means of the hydraulic lifting device of the vehicle can be put on the top side of an ensilage bale 5 and then be pressed in the direction downwards, the knife cutting itself through the bale in an effective way. The knife means can of course be swung in the vertical plane by means of the lifting device, which can be of value during certain phases of the procedure of the dividing into pieces.

Another way of dividing an ensilage bale into pieces is to turn the knife means in that way that the cutting edge of the knife blade is directed upwards and then insert the knife means into the bale for instance at the centre of the same. In that connection the bale will be divided into pieces by means of its own weight when the knife means is moved upwards.

In Figs. 2 and 3 is shown a preferred embodiment of the knife means more closely. According to this embodiment the knife means 4 comprises a spear-like stick 6 of the kind that is today used when lifting and handling bales in another way. This stick 6 that is preferably made of massive steel, has a rear portion 7 that it intended to be detachably fastened to the attachment device 3 by means of a bolt joint. This device 3 comprises a frame that is directed essentially vertically when the knife means has taken an essentially horizontal position. The stick 6, according to this embodiment, has an essentially circular cross-section as is shown i Fig. 3 but of course may have another cross-section, for instance square.

On the underside of the stick 6, preferably by means of a weld joint, is fastened a knife blade 8 which at the bottom has a cutting edge 9 in order to achieve a better cutting ability, which appears from Fig. 3. The cutting edge 9 of the knife blade 8 extends right up to the fore end 10 of the stick 6, which end 10 is pointedly designed. Due to that fact the stick 6 with the knife blade 8 can easily penetrate into an ensilage bale. An important part of the invention is that the knife means 4 has a broad, carrying surface at the top, whereby the

knife means after having been inserted into the ensilage bale can be used for lifting and/or removal of the same.

In connection with these activities torsional forces may arise on the knife means, having the consequence that this one can get loose from the attachment device. In order to prevent torsion of the knife means 4 in relation to the attachment device 3 heels or the like can be fastened on the attachment device, which has such an extension in the longitudinal direction of the knife means that they come on each side of the knife means 8.

According to another embodiment of the knife means, which is shown in Fig. 4 a spear-like stick 11 is intended to be fastened to the attachment device 3. The knife means 12 itself is fastened to this stick in that way that it cannot be turned in relation to the stick. The knife means 12 in this case comprises a tubular stick 13, which is closed and pointedly designed at the front and which is intended to be pushed on the outside of the stick 11 fastened to the attachment device, and a knife blade 14 fastened to the underside of the tubular stick 13.

The knife means according to Fig. 4 in similarity with the knife means according to Figs. 2, 3 has a broad, carrying surface at the top so that the knife means also can be used for lifting and transportation of bales.

A third embodiment of the knife means may comprise a stick and a knife blade which are made in one piece.

The invention herein described is intended to lift, to transport and to divide into pieces ensilage bales in the form of hay strings rolled up, the bale at first hand being divided into two equal parts. Of course, the invention may also be used for dividing the ensilage blocks into pieces which are cut out from plane silos with the technique existing today.

In the description has been talked about ensilage bales. Of course, the novel invention is also useable when lifting, transportation and dividing into pieces of other bales, for instance straw and hay bales.

The invention is of course not limited to what has been mentioned above but further modifications of the invention can be made within the scope of the following claims.

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Claims

1. A knife means for lifting, transportation and dividing into pieces of bales within agriculture, preferably ensilage bales, c h a r a c t e r i z e d by the combination of the following features:

- The knife means (4; 12) is intended to be fastened to the fore portion (2) of a hydraulic lifting device (1) on a vehicle, for instance a tractor;

- The knife means (4; 12) has an elongated form and is intended to cooperate with the hydraulic lifting device (1) in that way that the knife means (4; 12) can be brought to move essentially in the vertical plane with an essentially horizontal extension;

- The knife means (4; 12) is designed with a cutting edge (9) in its lower portion, whereby the knife means can effectively cut itself through the ensilage bale when making the essentially vertical motion;

- The knife means (4; 12) has a broad, carrying surface at the top so that after insertion into the ensilage bale it can effectively lift and/or move the same.

2. A knife means according to claim 1, this one being fastened to an attachment device (3) which in its turn is intended to be fastened to the hydraulic lifting device of the vehicle, c h a r a c t e r i z e d in that the attachment device (3) comprises a frame cooperating with the knife means (4) in that way that when this one has an essentially horizontal extension, the frame (3) takes an essentially vertical position, and that the knife means (4) comprises a portion (6), functioning as a support, and a knife blade (8) which is fastened to the underside of the portion (6).

3. A knife means according to claim 2, c h a r a c t e r i z e d in that the portion (6) and the knife blade (8) are made in one piece.

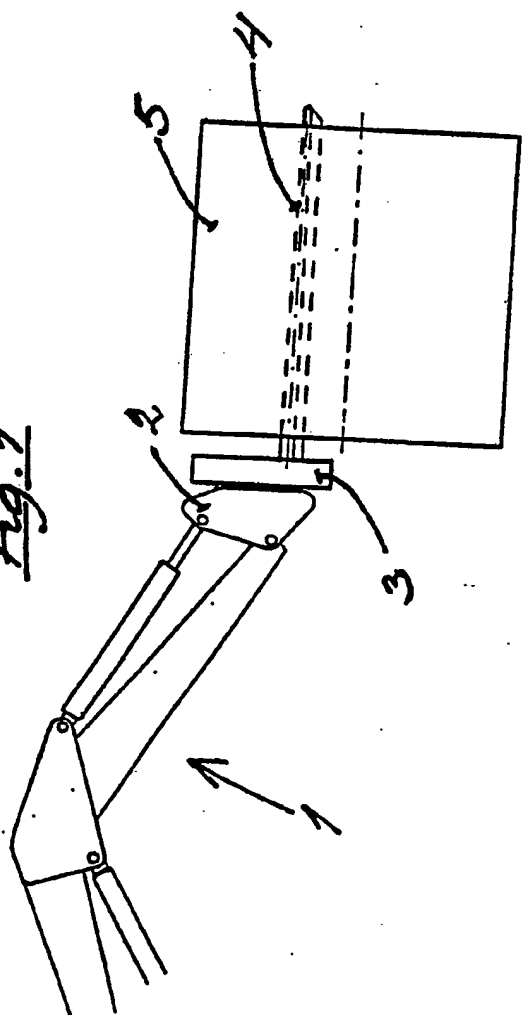
4. A knife means according to claim 2, c h a r a c t e r i z e d in that the portion (6) functioning as a support comprises a spear-like stick, the rear portion (7) of which comprises attachment means which make possible a detachable attachment of the stick (6) to the attachment device (3).

5. A knife means according to claim 1, this one being intended to cooperate with a spear-like stick (11), which is intended to be fastened to an attachment device (3) which in its turn is intended to be fastened to the fore portion (2) of the lifting device (1) of the vehicle, c h a r a c t e r -  
i z e d in that the knife means (12) comprises a tubular stick (13) which is closed and pointedly designed at the front and intended to be pushed on the outside of the stick (11) fastened to the attachment device (3), and that the tubular stick (13) has a knife blade (14) on its underside.

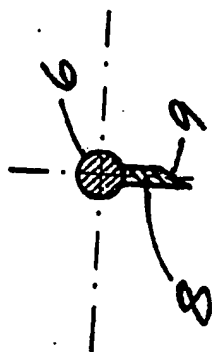
6. A knife means according to claim 3 or 5, c h a r -  
a c t e r i z e d in that the knife blade (8; 14) is provided with a cutting edge (9) at the bottom which extends up to the front portion of the tubular stick (13) and the stick (6) fastened to the attachment device (3).

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*Fig. 1*



*Fig. 3*



*Fig. 2*

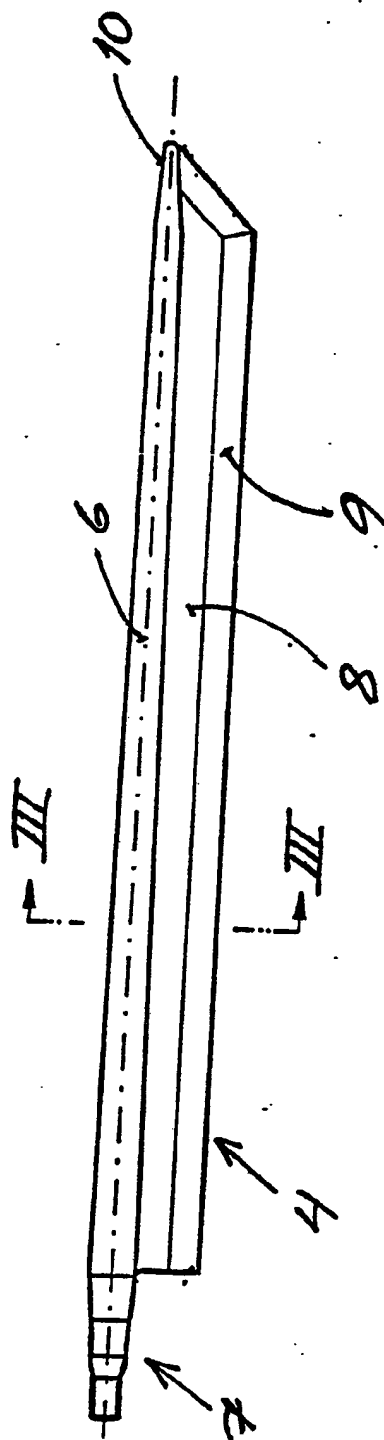
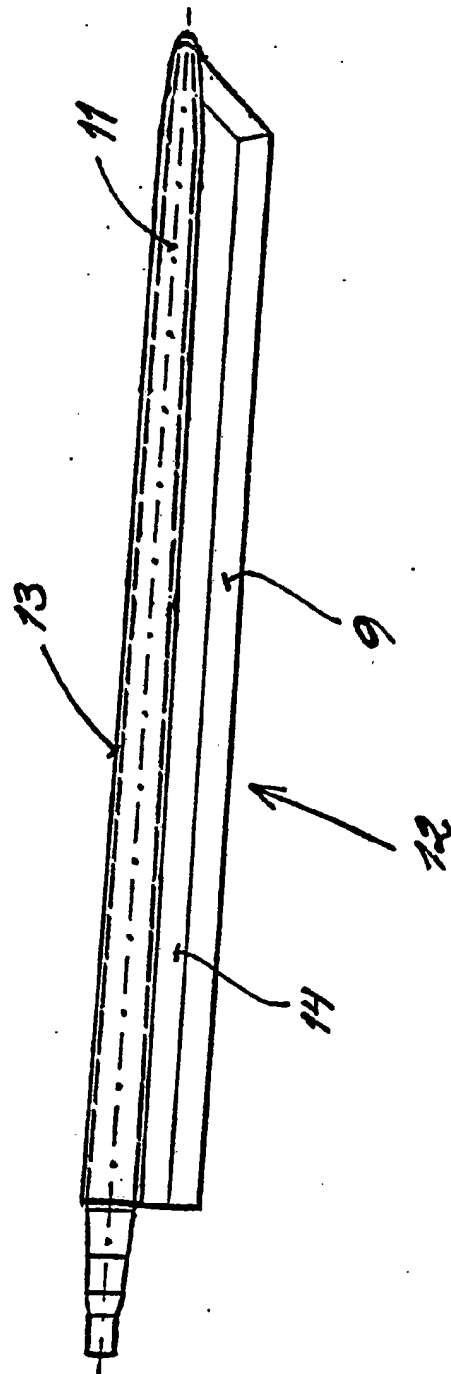




Fig. 4



# INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 90/00316

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC5: A 01 D 87/12, A 01 F 29/00</b>														
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched<sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border: 1px solid black; text-align: left;">Classification System</th> <th style="width: 75%; border: 1px solid black; text-align: left;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; vertical-align: top; padding: 5px;">IPC5</td> <td style="border: 1px solid black; vertical-align: top; padding: 5px;">A 01 D; A 01 F; B 66 F</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched<sup>8</sup></div> <p style="padding: 5px;">SE, DK, FI, NO classes as above</p>			Classification System	Classification Symbols	IPC5	A 01 D; A 01 F; B 66 F								
Classification System	Classification Symbols													
IPC5	A 01 D; A 01 F; B 66 F													
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border: 1px solid black; text-align: left;">Category *</th> <th style="width: 60%; border: 1px solid black; text-align: left;">Citation of Document,<sup>11</sup> with indication, where appropriate, of the relevant passages<sup>12</sup></th> <th style="width: 30%; border: 1px solid black; text-align: left;">Relevant to Claim No.<sup>13</sup></th> </tr> <tr> <td style="border: 1px solid black; vertical-align: top; text-align: center;">X</td> <td style="border: 1px solid black; vertical-align: top; padding: 5px;">US, A, 4771670 (WOERMAN) 20 September 1988, see column 3, line 31 - line 41 --</td> <td style="border: 1px solid black; vertical-align: top; text-align: center;">1-4, 6</td> </tr> <tr> <td style="border: 1px solid black; vertical-align: top; text-align: center;">A</td> <td style="border: 1px solid black; vertical-align: top; padding: 5px;">US, A, 4099629 (COX) 11 June 1978, see figure 3 --</td> <td style="border: 1px solid black; vertical-align: top; text-align: center;">2-4</td> </tr> <tr> <td style="border: 1px solid black; vertical-align: top; text-align: center;">A</td> <td style="border: 1px solid black; vertical-align: top; padding: 5px;">WO, A1, 8810064 (BERG) 29 December 1988, see abstract; figures 1, 2 -- -----</td> <td style="border: 1px solid black; vertical-align: top; text-align: center;">1</td> </tr> </table>			Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	X	US, A, 4771670 (WOERMAN) 20 September 1988, see column 3, line 31 - line 41 --	1-4, 6	A	US, A, 4099629 (COX) 11 June 1978, see figure 3 --	2-4	A	WO, A1, 8810064 (BERG) 29 December 1988, see abstract; figures 1, 2 -- -----	1
Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>												
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><b>* Special categories of cited documents:<sup>10</sup></b></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>														
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border: 1px solid black; vertical-align: top; padding: 5px;">           Date of the Actual Completion of the International Search   <b>6th December 1990</b> </td> <td style="width: 50%; border: 1px solid black; vertical-align: top; padding: 5px;">           Date of Mailing of this International Search Report   <b>1990 -12- 11</b> </td> </tr> <tr> <td style="border: 1px solid black; vertical-align: top; padding: 5px;">           International Searching Authority   <div style="text-align: center;"><b>SWEDISH PATENT OFFICE</b></div> </td> <td style="border: 1px solid black; vertical-align: top; padding: 5px;">           Signature of Authorized Officer  <div style="text-align: center;">Anders Bruun</div> </td> </tr> </table>			Date of the Actual Completion of the International Search  <b>6th December 1990</b>	Date of Mailing of this International Search Report  <b>1990 -12- 11</b>	International Searching Authority  <div style="text-align: center;"><b>SWEDISH PATENT OFFICE</b></div>	Signature of Authorized Officer <div style="text-align: center;">Anders Bruun</div>								
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International Searching Authority  <div style="text-align: center;"><b>SWEDISH PATENT OFFICE</b></div>	Signature of Authorized Officer <div style="text-align: center;">Anders Bruun</div>													

# **ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 90/00316**

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4771670	88-09-20	NONE	
US-A- 4099629	78-06-11	US-A- 4015739	77-04-05
		US-A- 4082192	78-04-04
WO-A1- 8810064	88-12-29	AU-D- 1802188	89-01-19
		EP-A- 0375688	90-07-04